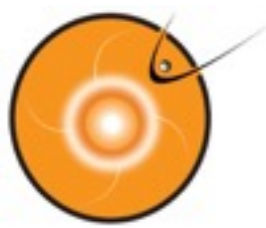


CCMC Collaboration with SPENVIS

Yihua Zheng on behalf of Justin Boblitt

Stijn Calders,
Neophytos Messios,
Norma Crosby

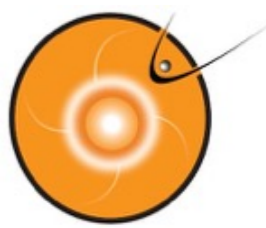


Collaboration Goals

ESA's Space Environment Information System (SPENVIS) team and CCMC have overlapping goals to (1) host space environment and impact models for the community and (2) facilitate the improvement of modeling capabilities.

By interlinking expertise, systems, and data (largely through APIs), both teams can:

- **Provide access to a larger catalog of models**
- **Enhance modeling capabilities of engineering impact models**
- **Provide greater services to mission operators and community**



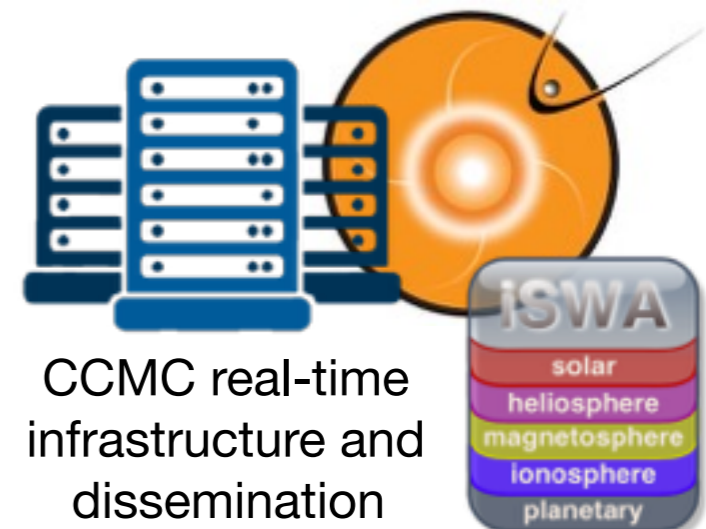
How can we achieve these goals?

Utilize each other's strengths:

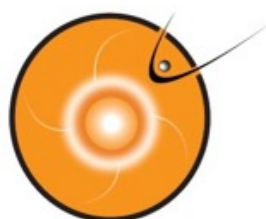
- **SPENVIS** team provides **great services to missions** through their online interface, and has a **machine-interface for submitting impact/environmental model runs**
- **CCMC** has **real-time infrastructure** for executing, archiving, and disseminating models/results

As an initial, immediate enhancement to both team's modeling capabilities, we can (interlink our systems):

- Utilize SPENVIS machine interface to **execute SPENVIS models in an automated fashion**, providing operators with satellite effects/conditions over time
- Utilizing CCMC's real-time infrastructure and dissemination to **provide real-time environmental conditions from the CCMC's collection of real-time models**



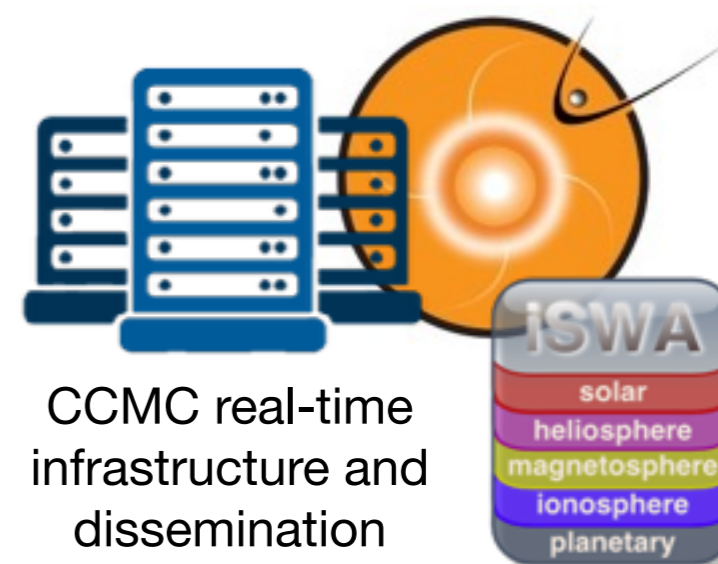
**Remote/Automated SPENVIS executions,
using real-time environmental conditions
from CCMC model output**



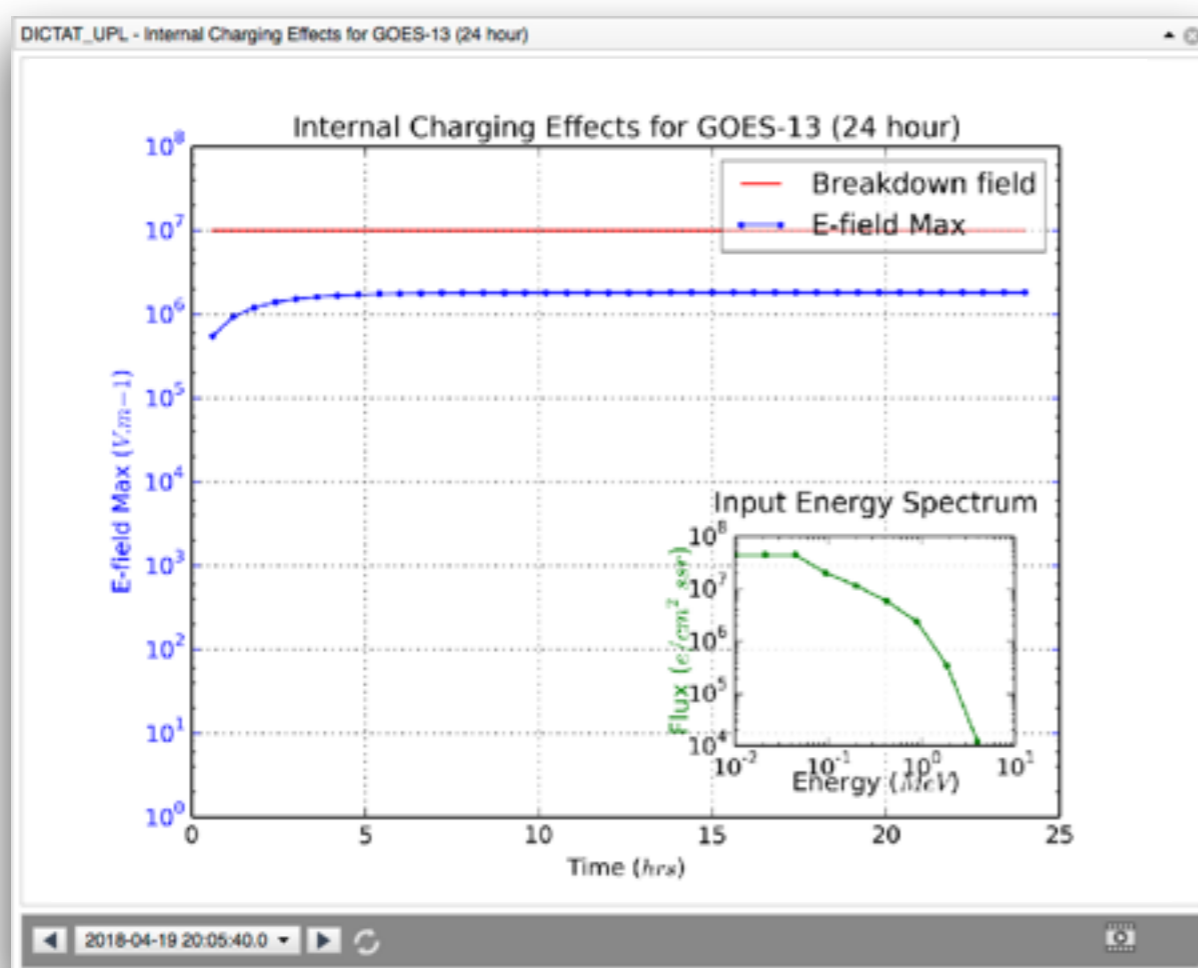
Proof of concept - DICTAT_UPL Internal Charging Effects for GOES-13



Remote execution of DICTAT-UPL
Spacecraft Charging model



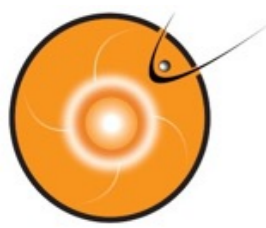
Fok Radiation Belt
Electron (RBE) Model
as DICTAT input



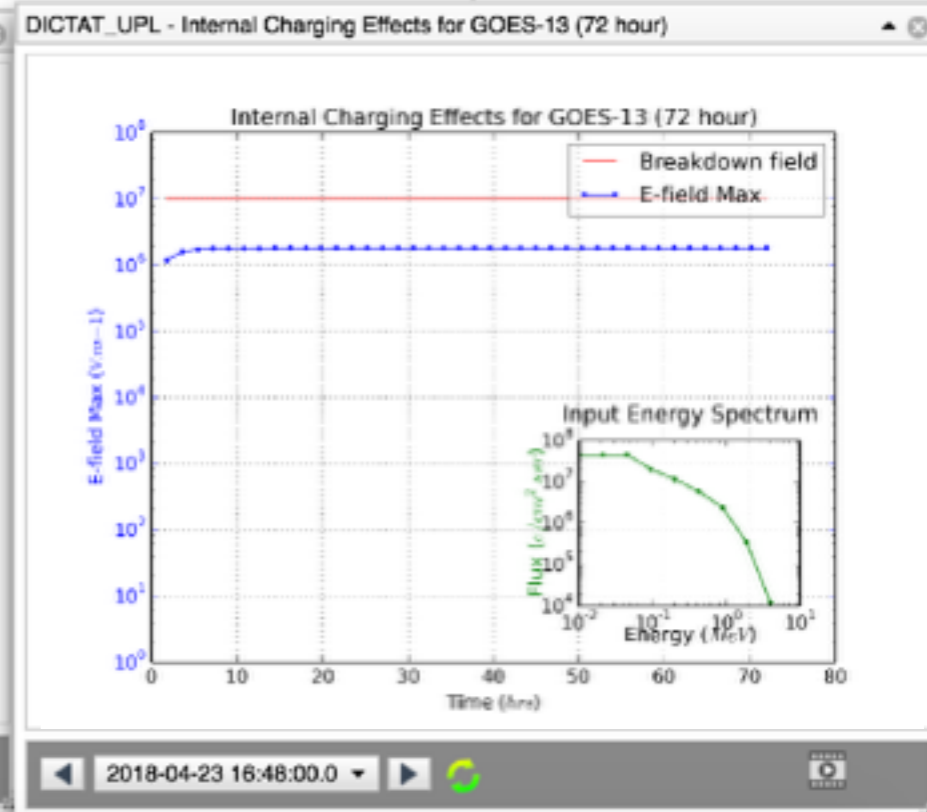
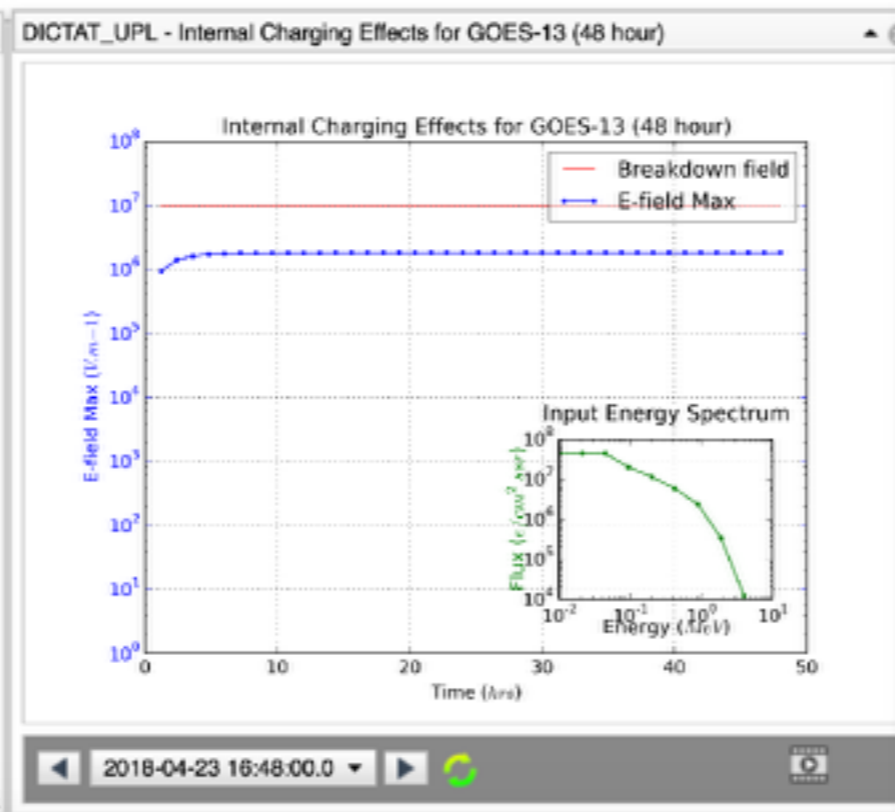
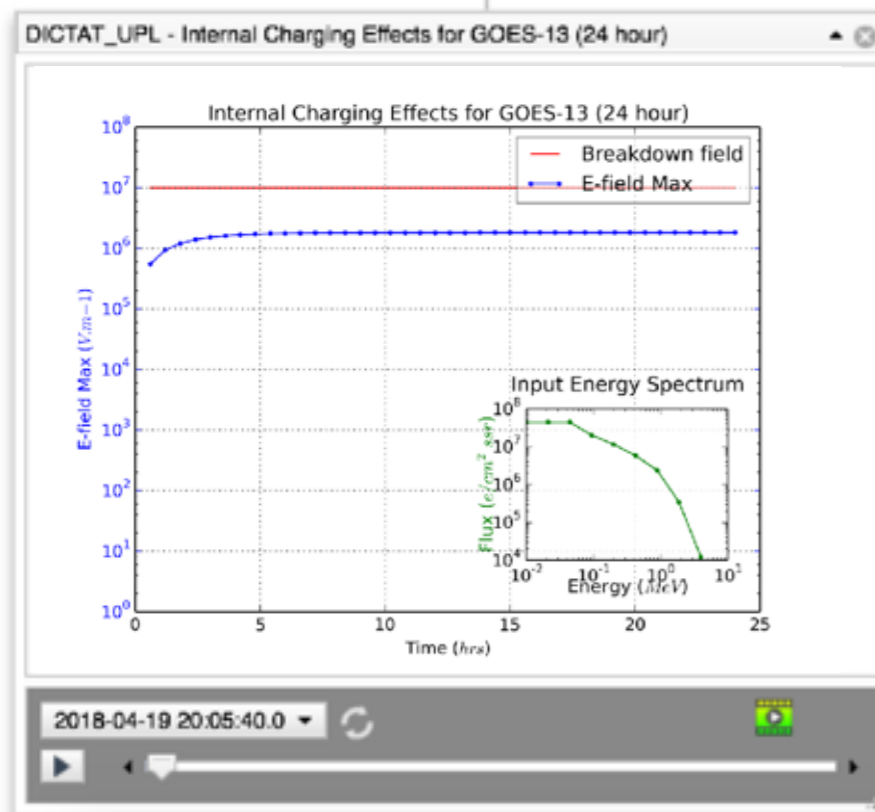
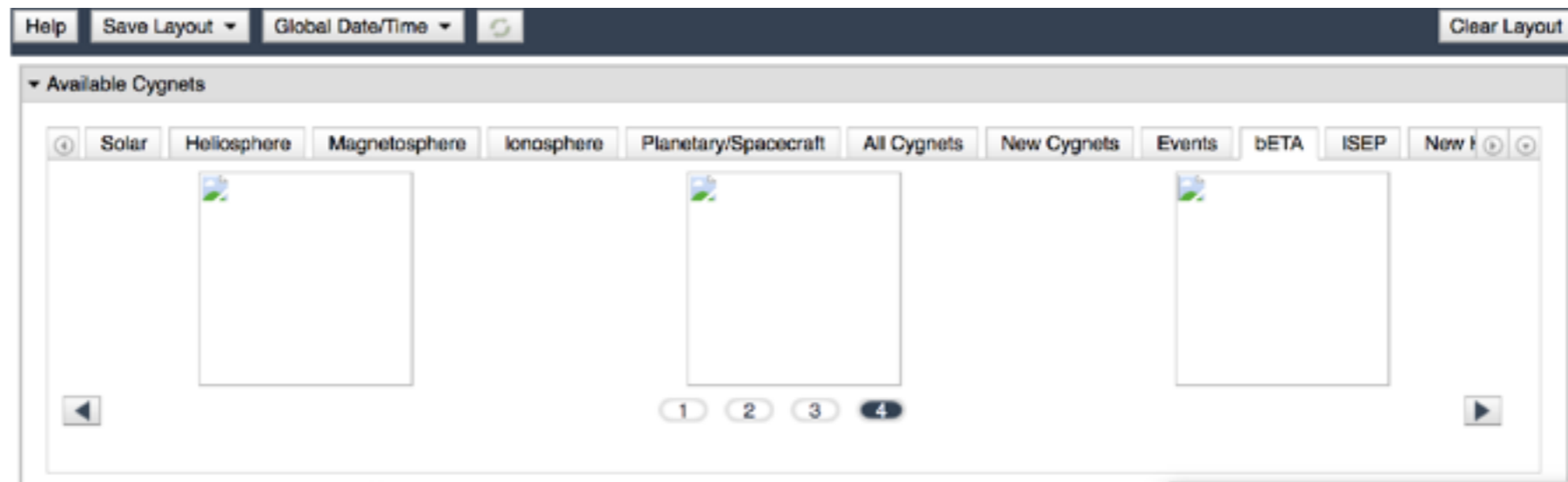
User can view SPENVIS model output in iSWA

<https://www.spennis.oma.be/help/background/charging/dictat/dictatman.html>

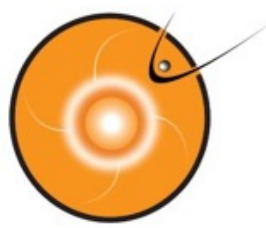
<https://ccmc.gsfc.nasa.gov/models/modelinfo.php?model=Fok%20Radiation%20Belt%20Electron>



Proof of concept results: 3 new internal charging effects iSWA cygnets



- GOES-13 effects if exposed to electron flux conditions for 24, 48, or 72 hours, and whether has potential to reach breakdown voltage (electric static discharge)
- Beta section of iSWA - still need to make adjustments and run more tests



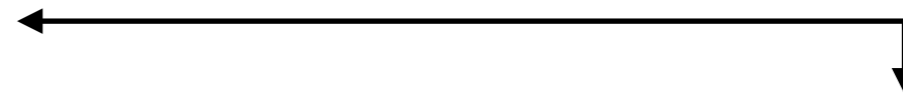
SPENVIS team a key to this success



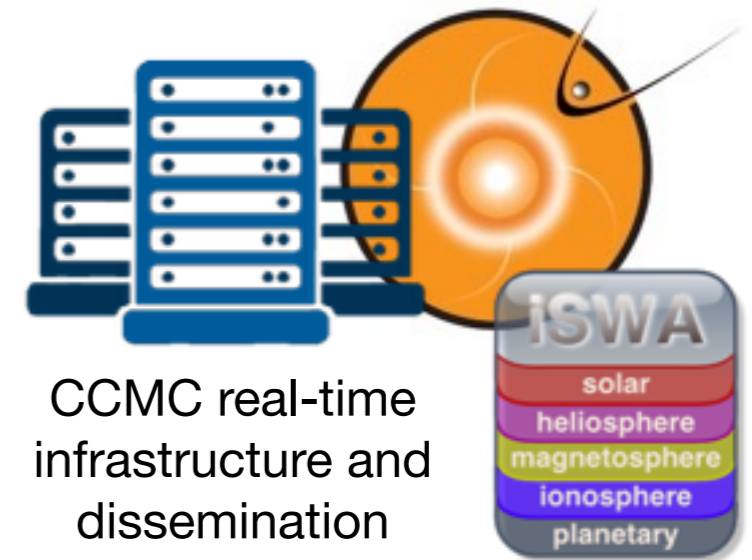
DICTAT-UPL Spacecraft Charging model

**SPENVIS team provided
(components in blue/purple):**

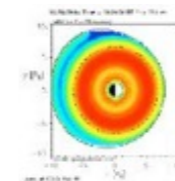
1. Engine for executing models,
2. Machine interface to start the executions and download results
3. Self-contained Python API package to easily communicate with Machine interface:



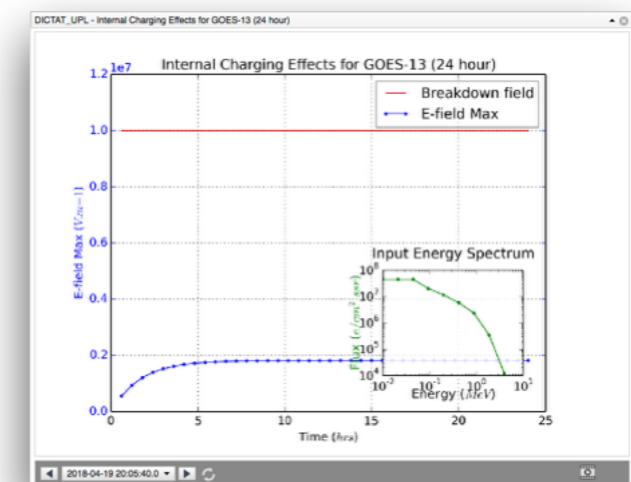
SPENVIS Python API

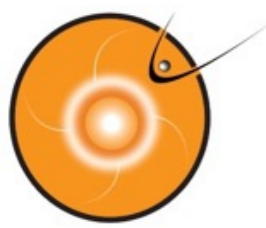


CCMC real-time
infrastructure and
dissemination



Fok Radiation Belt
Electron (RBE) Model





Impact / Future

- This is one example of how CCMC and SPENVIS team can **combine expertise and connect systems to achieve new capabilities.**
- DICTAT_UPL is proof-of-concept model that is now more **useful for mission operators to assess internal charging and risk for discharge at a target spacecraft**
- We would like to **build upon this collaboration by expanding to new models** to which we can provide real-time model input and other dissemination services
- **Thank to the SPENVIS team for their support!** I have enjoyed working with their software team. The community can utilize SPENVIS's python api for remote executions, or even suggest particular models to us to incorporate.
- **New concept of “on-boarding” models and having them executed/displayed in automated fashion without having to physically install at the CCMC**